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FTPC Simulations

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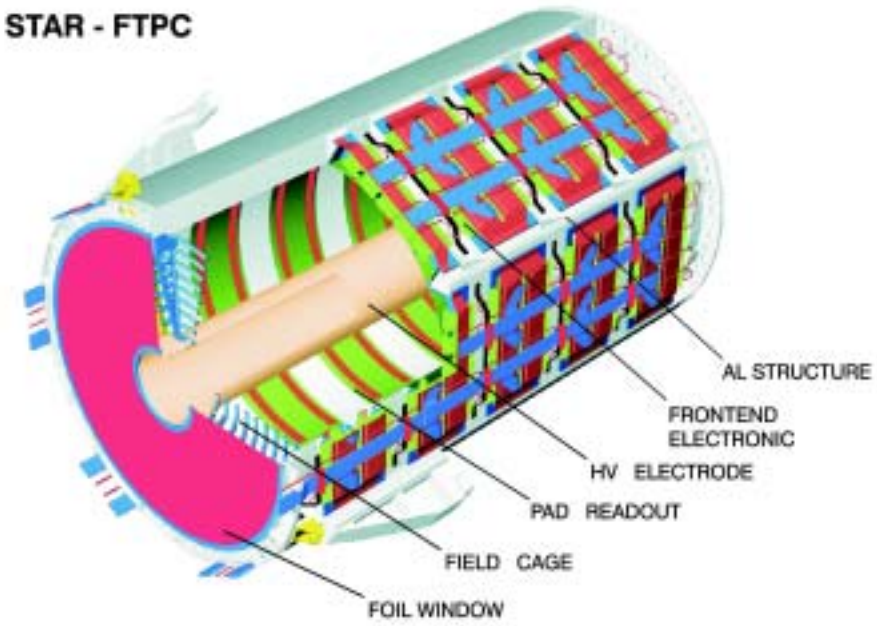
Outline

- The FTPC
- The FTPC Slow Simulator
- Preliminary Results from Simulations
- Conclusion and Outlook

FTPC: The Detector

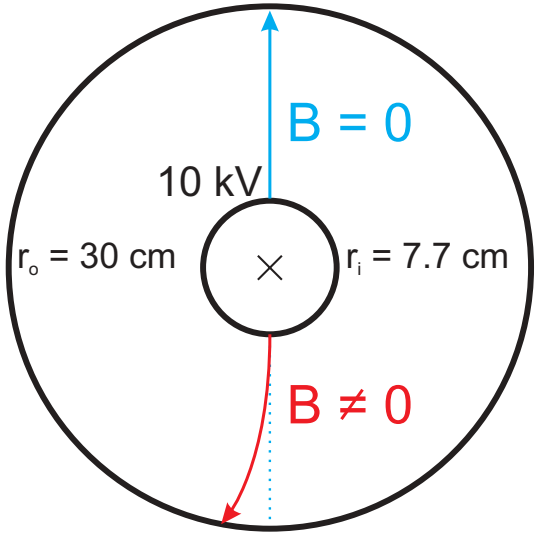


- $2.5 < |\eta| < 4.0$
- 10 rows, 960 pads each
  $\Rightarrow$ 9600 channels / FTPC
- 256 time bins / pad
- each row subdivided into 6 sectors
- gas mixture Ar/CO_2 50/50

In STAR: 2 FTPCs (East & West) cover forward and backward rapidity region

Important: Radial electron drift (perpendicular to magnetic field)
to optimize the two-track resolution and the momentum determination

FTPC: Radial Drift



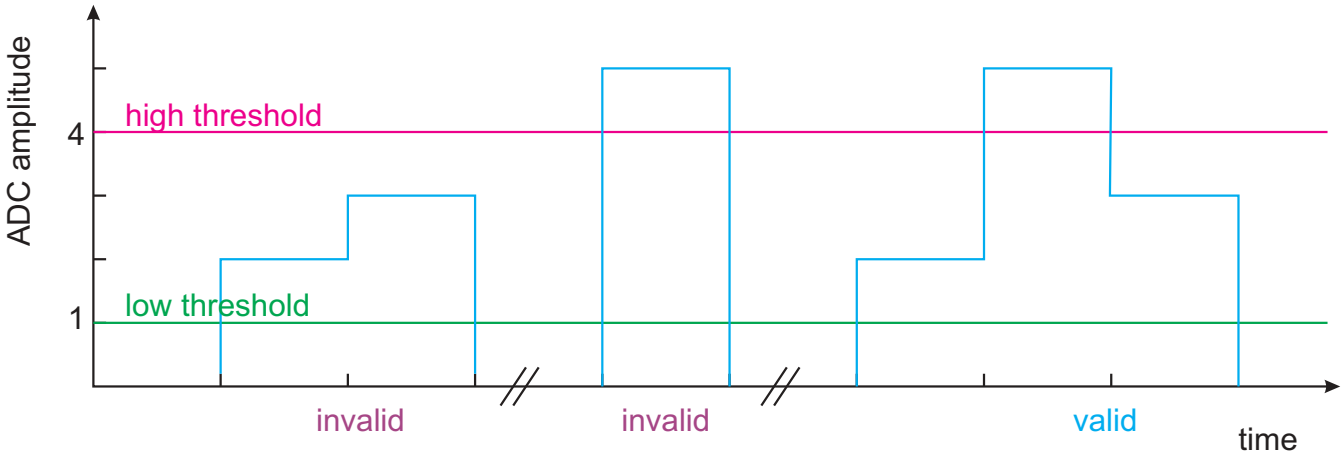
- no B field
  $E \propto 1/r \Rightarrow v_D \neq const$
  $(v_D \sim 0.3\,cm/\mu s \ldots 2.0\,cm/\mu s)$
- with B field
  $\vec{E} \perp \vec{B} \Rightarrow \vec{F} = q(\vec{E} + \vec{v_D} \times \vec{B})$
  $\Rightarrow$ deflection angle is a function of r

For accurate reconstruction and simulation:

- drift velocity v_D has to be know with an accuracy of $\sim$ 0.1%
- Lorentz deflection has to be calculated with MAGBOLTZ
- precise knowledge of the gas composition, pressure and temperature necessary

FTPC Slow Simulator

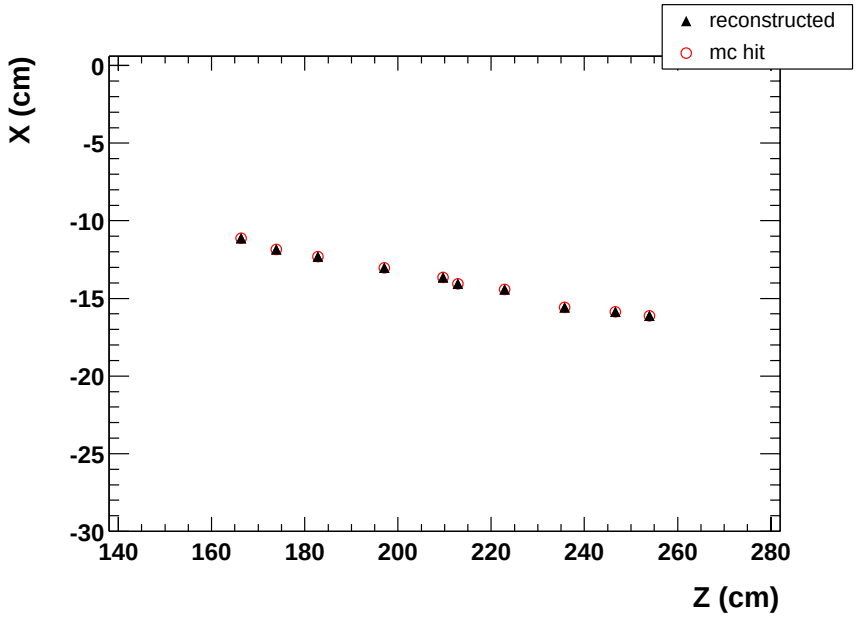
- electron drift, diffusion and pad response simulated
- DAQ mapping used
- ASIC parameters implemented in the simulation:



- AssociationMaker used to evaluate simulated data
- used associator cuts:
  hits: max distance in r: 1 mm, max distance in φ: 1°,
  tracks: number of common hits to associate a track: 5

Simulator: Hits

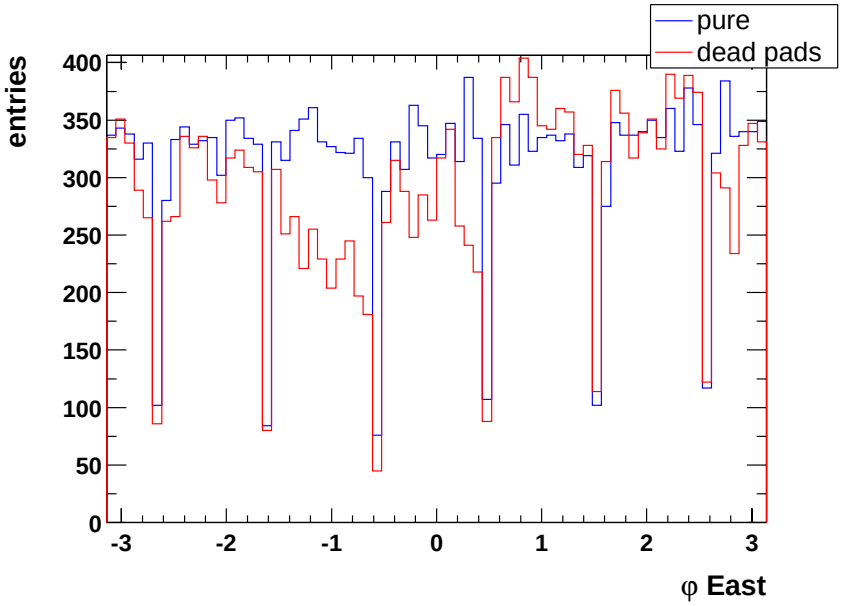
- using 100 central AuAu Hijing events for $\sqrt{S_{NN}} = 200\,GeV$
- typical Hijing event creates $\sim$ 18 000 FTPC hits
- $\sim$ 67% of the number of FTPC GEANT hits found
- $\sim$ 97% of found hits associated

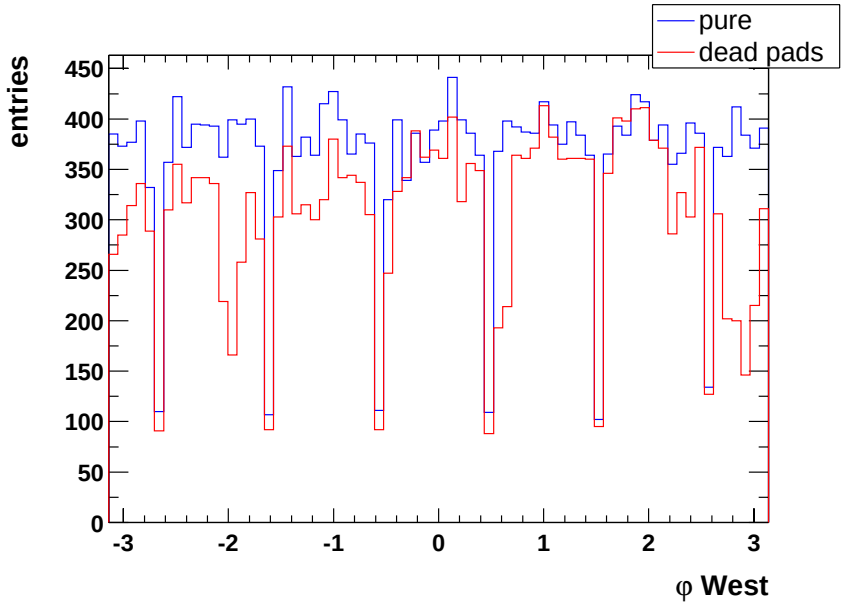


Problems to be solved:

- distribution of hit residuals too narrow (of the order of 15 μm)
  $\Rightarrow$ electronic noise should be included in the simulation
- pad and time distribution of simulated clusters too narrow compared to real data
  $\Rightarrow$ adjust diffusion parameters and pad response function

Results: Influence of dead pads



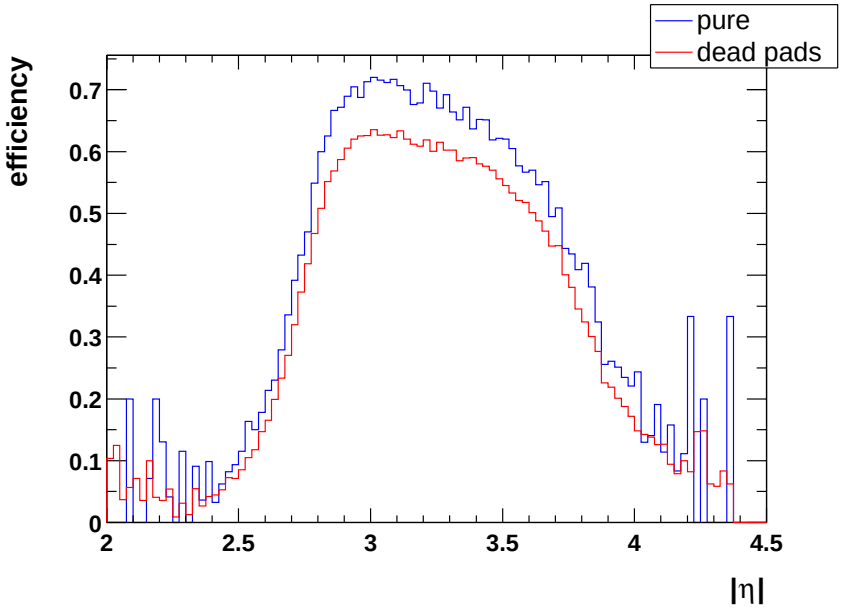


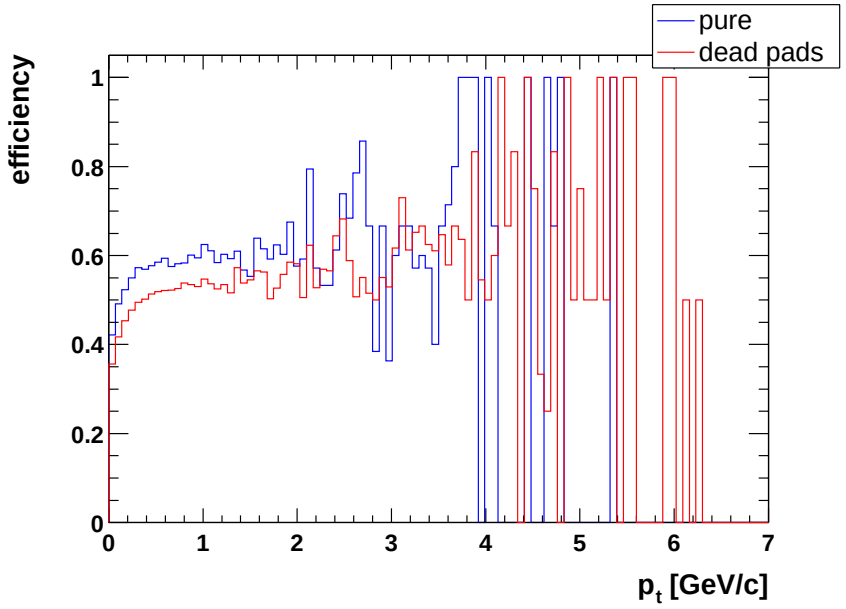
the plots show the average φ of the hits on each track that was reconstructed and associated

- pads flagged out in the reconstruction (noisy pads) included in simulation

  $\Rightarrow$ regions with significant reduction in tracking efficiency due to lost hits

Results: Efficiency

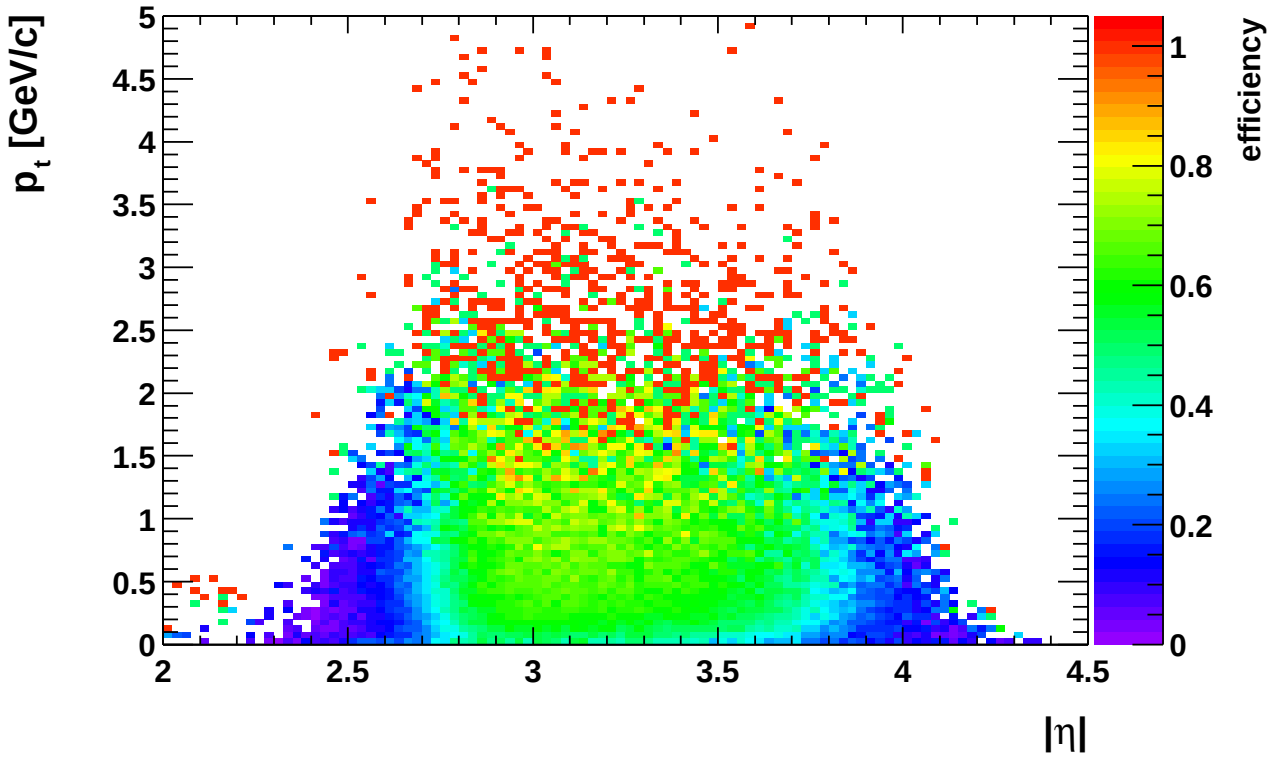




- efficiency = $\frac{\text{number of associated primary tracks}}{\text{number of good primary FTPC tracks}}$

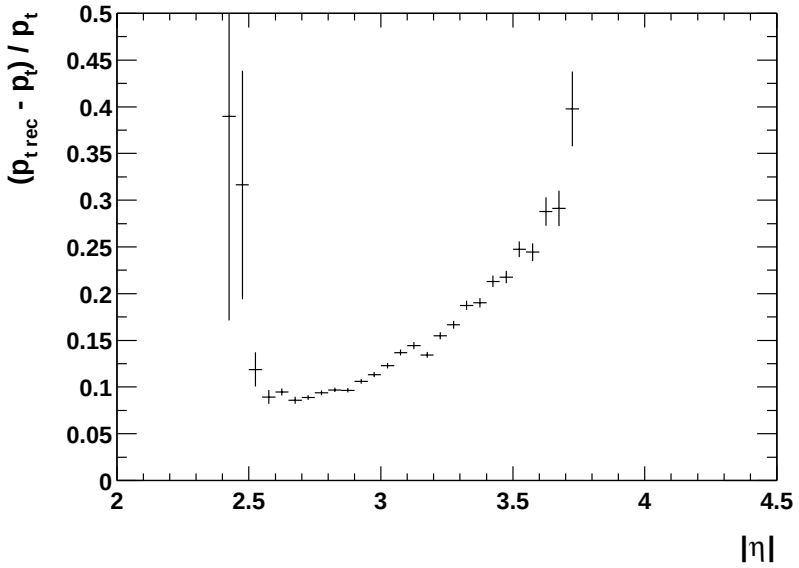
- good FTPC tracks: a track that leaves 5 to 10 GEANT hits in the FTPC
  important: GEANT hits are counted also in dead regions of the FTPC (sector boundaries)
  $\Rightarrow$ geometrical acceptance included in efficiency

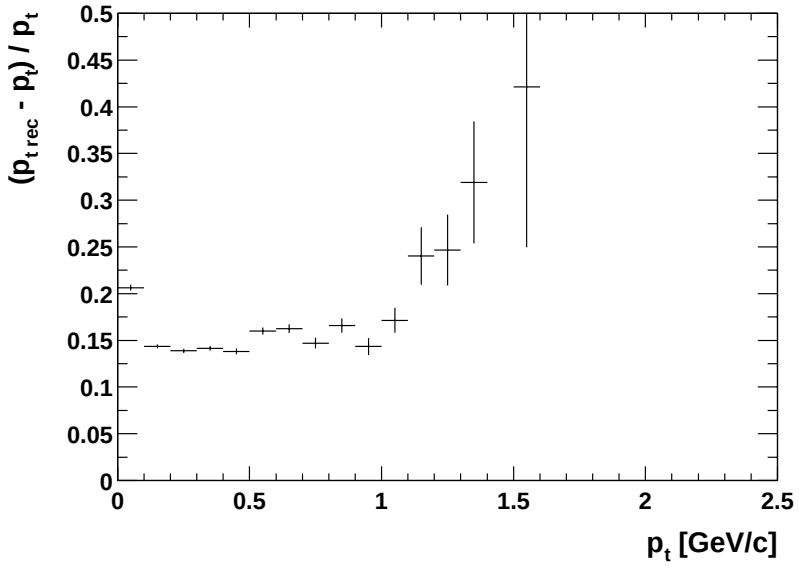
Results: Efficiency II



- efficiency as a function of $|\eta|$ and p_t
- result of 500 Hijing events

Results: Momentum Resolution





- p_t resolution as a function of $|\eta|$ and p_t
- especially for higher p_t ($>$ 1.2 GeV/c) very low statistics

Conclusion and Outlook

- revised FTPC SlowSimulator working
- good interplay with AssociationMaker
- resonable results from tests with 100 central Hijing events

What comes next?

- tuning of simulator parameters to reproduce observed cluster shapes
- detailed study of acceptance, efficiency and resolutions
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